

Based on the CCEE Heart Monitor (CCEEHM) framework detailed in the provided text, here are the specific formulae and algorithms required to produce the system's scores.

The system is divided into two primary scoring engines: the **Contact Hour (CH) Calculator** (Structural Quality) and the **Program Quality Indicators (PQI) Assessment** (Process Quality).

I. Structural Quality Algorithms: The Contact Hour (CH) Metric

The CH metric calculates the "density" of adult-child interaction over time to determine compliance with ratios and group size.

1. Input Variables

You must first collect the following six data points :

- TO_1 : Time facility opens (or first staff arrives).
- TO_2 : Time facility closes (or last staff leaves).
- TA : Total number of teaching/caregiving staff.
- NC : Number of children on maximum enrollment day.
- TH_1 : Time the last child arrives (start of full enrollment).
- TH_2 : Time the first child leaves (end of full enrollment).

2. Intermediate Calculations

Calculate the duration of the operational day and the duration of full enrollment:

$$TO = TO_2 - TO_1$$

$$TH = TH_2 - TH_1$$

(Note: Ensure times are converted to decimal hours for calculation, e.g., 8:30 AM = 8.5)

3. The Core Formulae

Select the appropriate formula based on the density distribution. The **Trapezoidal Model** is the standard for most programs with staggered arrivals/departures.

$$CH = \frac{\frac{NC \times (TO + TH)}{2}}{TA}$$

- **Rectangular Model (Reference/Efficiency):** Used when all children arrive/leave simultaneously (Reference Standard).

$$CH = \frac{NC \times TO}{TA}$$

- **Triangular Model:** Used when full enrollment is a single point in time.

$$CH = \frac{\frac{NC \times TO}{2}}{TA}$$

- **Squared Model (Alternative):**

$$CH = \frac{NC^2}{TA}$$

4. Compliance Algorithm (Scoring Logic)

To determine if the calculated CH score is compliant:

1. **Retrieve Reference Value:** Look up the "Relatively Weighted Contact Hour" (RWCH) value in the **Contact Hour Conversion Table** (Table 1) corresponding to the program's Number of Children (NC) and legally required Adult-Child Ratio (ACR).
2. **Compare:**
 - **IF $Calculated_CH \leq Reference_RWCH$: Compliant** (Healthy Structural Quality).
 - **IF $Calculated_CH > Reference_RWCH$: Non-Compliant** (Overpopulated/High Structural Stress).

II. Process Quality Algorithms: Program Quality Indicators (PQI)

The PQI engine calculates a weighted score based on 10 validated indicators, converting raw data into a 1-4 ordinal scale .

Universal Scoring Scale (Percentage to Ordinal)

For Indicators 1, 2, 3, and 4, convert the raw percentage to a score using this logic:

- **0% – 25%:** Score = 1
- **26% – 50%:** Score = 2
- **51% – 75%:** Score = 3
- **76% – 100%:** Score = 4

Indicator-Specific Algorithms

PQI 1: ECE III Educators

$$Percentage = \left(\frac{\text{Number of ECE III Staff}}{\text{Total Teaching Staff}} \right) \times 100$$

Apply Universal Scoring Scale.

PQI 2: Stimulating Environment

$$Percentage = \left(\frac{\text{Count of 'Yes' on 11 Checklist Items}}{11} \right) \times 100$$

Apply Universal Scoring Scale.

PQI 3: Curriculum & Assessment

- Sample 10 child records.
- For each record, verify 3 key elements (Emergent curriculum, Co-learning, Documentation).
- **Record is Positive** only if ALL 3 elements are present.

$$Percentage = \left(\frac{\text{Number of Positive Records}}{10} \right) \times 100$$

Apply Universal Scoring Scale.

PQI 4: Staff & Family Opportunities

$$Percentage = \left(\frac{\text{Count of 'Yes' on 3 Policy Items}}{3} \right) \times 100$$

Apply Universal Scoring Scale.

PQI 5: Child Progress Reporting Calculate raw points:

- **IF** (Conferences \geq 2x/yr **AND** Written Report provided): **+3 Points**
- **ELSE IF** (Conferences \geq 2x/yr **ONLY**): **+2 Points**
- **ELSE IF** (Written Report **ONLY**): **+1 Point**
- **ADD** (Culturally/Linguistically Appropriate): **+1 Point**
- **Final Score** = Total Points (Max 4).

PQI 6, 7, 8: Observational Levels

- These indicators use hierarchical checklists (Level 1 criteria, Level 2 criteria, etc.).
- **Algorithm:** Assign the score of the highest level where **ALL** criteria are met.
- *Partial Credit:* If Level X is fully met and Level $X + 1$ is partially met, score can be recorded as $X +$ (treated as intermediate in advanced stats, but typically rounded or floored for standard scoring).

PQI 9 & 10: Timed Observations (Attention & Warmth)

- Conduct 10 observations (2 minutes each).
- Rate each on Likert scale (1-4).
- **Algorithm:**

$$Average = \frac{\sum_{i=1}^{10} Observation_Score_i}{10}$$

$$Final_Score = Round(Average)$$

(e.g., 3.7 rounds to 4; 2.2 rounds to 2).

III. Final Synthesis Algorithm

To produce the final Program Quality Rating, sum the PQI scores and apply the threshold logic.

Calculate Total PQI:

$$Total_Score = \sum(PQI_1 + \dots + PQI_{10})$$

(Note: Exclude PQI 7 for Preschool programs or PQI 6/8 for Infant programs if applicable, and adjust thresholds accordingly).

Determine Quality Level (PQIAI Scoring Protocol):

Quality Level	Mixed Age Score	Preschool Score	Infant-Toddler Score
High Quality	36+	32+	28+
High-Mid Quality	30 – 35	26 – 31	22 – 27
Mid-Low Quality	20 – 29	16 – 25	12 – 21
Low Quality	< 19	< 15	< 11